

# Required Navigation Performance RNP

## Conventional Procedures

Conventional navigation procedures are designed using ground-based navigation aids (navaids) for en route operations (e.g., VOR/DME) and terminal operations (e.g., ILS). En route navaids project radials, akin to the spokes of a wheel, which form intersections with other navaids and establish the basis of our airway system. An ILS projects a limited directional signal and a vertical path signal, enabling pilots to fly an approach and glide slope to a specific runway.

## Area Navigation (RNAV)

RNAV is a system that allows navigation on any desired flight path rather than one defined by ground-based radials. An RNAV system can determine position by referencing the position of ground navigation aids, or through a self-contained inertial reference unit (IRU), or space-based systems such as the Global Positioning System (GPS). RNAV uses navigation waypoints to define routes. RNAV procedures do not have the traditional navaid dependencies inherent with ground-based navaids. This allows RNAV procedures to be developed along optimum paths.

## Required Navigation Performance (RNP)

Ongoing development of navigation technology has resulted in a refinement of RNAV called Required Navigation Performance (RNP). RNP is performance-based and not dependent on a specific piece of equipment. It is a statement of navigation position accuracy necessary for operation within a defined airspace. RNP is not new hardware for the cockpit or new navaids. It establishes highly refined parameters for aircraft airspace containment including:

- Navigation performance accuracy, within which the navigation system is expected to remain 95% of the time
- Airspace for continuity and integrity in addition to the 95% area

The combined areas will ensure aircraft containment 99.9% of the time. Navigation performance for a particular RNP type, or number, is related to the size of an area evaluated for aircraft containment.

A descriptive number attached to RNP; e.g. RNP-2 and RNP-3, can be applied to a large region of airspace or to a unique approach procedure. The value is an indicator of the size of the containment area and also defines the navigation equipment an aircraft must have to operate in that airspace. In the United States, different RNP values can be assigned for terminal approach procedures, departure procedures and en route operations. For instance, terminal area approach procedures require very precise navigation and much smaller containment area (RNP value) within which the aircraft must remain while landing on a particular runway. En route airspace requires less finite navigation, and therefore larger containment areas to ensure track-to-track separation from other routes.

## Expected RNP Benefits

By refining navigation system performance and airspace containment to a 99.999% certainty, maximum benefit can be derived from RNP. The accurate, repeatable path, integrity and continuity ensure procedures will be flown in the same manner by all aircraft. Controllers can then expect aircraft to be at a specific position with a high degree of confidence, thus maximizing safety and the efficient flow of aircraft through airspace. This improved containment will be used to refine obstacle evaluation when developing routes and procedures. Other benefits are:

- Reduced route separation resulting in increased airspace capacity and efficiency
- Improved obstacle clearance limits
- Lower landing weather minimums
- Reduced pilot and controller workload
- More "fly direct to" capability and capacity

